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(54) Sheet surface processing method and apparatus.

(57) The present invention provides a printed sheet with a resin coating, lustered surface, a surface pattern of arbitrary shape and so on without using a long and large resin film. An ultra-violet ray hardening resin coating material is applied on one surface of a sheet to be coated 2 except for its edge portion. The coating material applied surface of the sheet 2 is laminated in a substantially non-oxygen state on an endless film 9 made of an ultra-violet ray transmissible material and having its surface matted or formed in an uneven pattern of arbitrary shape. The ultra-violet ray hardening coating material on the applied surface is irradiated through the endless film 9 with an ultra-violet ray to be hardened such that it is adhered on the sheet to be coated 2. Then, an external force is applied to the edge portion of the coated sheet 2 to peel the same from the endless film 9. Thus, a variety of patterned surfaces can be provided without the necessity of a long and large resin film.

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The present invention relates generally to sheet surface processing, and more particularly to a method and apparatus for processing a sheet surface such as the lustering of a painted member like a printed surface of a sheet by an ultra-violet ray hardening resin being coated thereon, and the formation of a mat surface by making arbitrary unevenness on the surface of a sheet.

Generally for lustering a printed surface of, for example, a sheet, a resin varnish is coated on the printed surface, a pressure is applied to flatten the varnish coated surface, and the resin varnish is hardened by a thermal drying process. This conventional lustering method thus requires a heating process by means of a vapor and a cooling process using water, thereby resulting in that the apparatus used therefor becomes complicated and expensive in addition to increased operation costs.

For this reason, with the commercialization of an ultra-violet hardening resin which is hardened by an ultra-violet ray being irradiated thereto, there has been developed a lustering method using such an ultra-violet ray hardening resin which is coated on a printed surface of a sheet. This lustering method coats an ultra-violet ray hardening resin coating material on a printed surface of a sheet by using a roll coater, gravure coater, flexo-coater, silk screen or the like, and then irradiates the coated surface with an ultra-violet ray to harden the resin on the surface. To obtain a flat surface, a long leveling zone is provided between a coating material applying section and an ultra-violet ray irradiating section to perform a natural leveling by heat softening with hot air, IR, or the like. With this method, however, difficulties have been encountered in lustering a printed surface of a sheet in a mirror-like state.

In recent years, there have been developed several apparatus for solving the above-stated problems which have been known, for example, by Japanese Laid-open Patent Application Nos. (hereinafter simply written "JP-A-") 56-37398 and 63-278847. The latter one is in the name of the present applicant.

Specifically explaining, JP-A-56-37398 coats an ultra-violet ray hardening resin coating material over the whole surface of a printed surface of a sheet or a resin film by the use of a roll coater. Then, the sheet and the resin film are stuck with each other so as to place the coated surface in the middle and pressurized from the outside to substantially remove oxygen from the adhered surfaces. Afterward, the ultra-violet ray hardening resin coating is irradiated with an ultra-violet ray to be deposited on the printed surface of the sheet. Finally, the resin film only is peeled to make a lustered printed surface in a mirror state.

JP-A-63-278847, assigned to the present assignee, employs a plate roller to enable an ultra-violet ray hardening resin coating material to be partially coated on a printed surface of a sheet, in contrast to the above-stated prior art which employs a roll coater for coating an ultra-violet ray hardening resin coating material on a printed surface of a sheet or a resin film. This structure thus allows an overlap width for gluing to be provided on a mirror-like lustered surface, thereby making it quite easy to adhere a lustered printed surface on the surface of a box or the like. However, by coating an ultra-violet ray hardening resin coating material over a printed surface of a sheet except for its edge portion, part of the ultra-violet ray hardening resin coating material overflows between the printed surface and the resin film. When the ultra-violet ray is emitted for hardening, this overflowing part of the ultra-violet ray hardening resin coating material is exposed to an oxygen atmosphere, thereby preventing the same from being hardened. Such a phenomenon of an ultra-violet ray hardening resin coating material remaining unhardened is referred to as "depressurization". It is therefore not possible to completely adhere the ultra-violet ray hardening resin coating material coated on the resin film to the printed surface of the sheet without any ultra-violet ray hardening resin coating material remaining on the resin film which is thus not repeatedly usable.

Since a roll coater is used to coat an ultra-violet ray hardening resin coating material on a printed surface of a sheet or a resin film, JP-A-56-37398 cannot provide an overlap width on the printed surface, which results in difficulties in gluing between two lustered surfaces. It is also difficult to prevent the above-stated depressurization from occurring, so that the resin film will not be repeatedly utilized.

JP-A-63-278847 is advantageous over JP-A-56-37398 in that an overlap width can be provided on a lustered printed surface of a sheet and the depressurization can be prevented. However, since a long and large resin film must be used, the processing system as a whole becomes so complicated and large that its operation is extremely time-consuming.

Viewed from one aspect the present invention provides a method of processing a sheet surface comprising the steps of: applying an ultra-violet hardening resin coating material on an endless film made of an ultra-violet transmissible material and having at least part of its surface matted or on the surface of said sheet to be processed; laminating the sheet and said endless film so that said coating material is sandwiched between said sheet and said endless film except for an edge portion; irradiating the ultra-violet ray hardening resin coating

material with ultra-violet radiation through said endless film to harden the ultra-violet hardening resin coating material in such a manner that the ultra-violet ray hardening coating material is adhered on said sheet to be coated; and applying an external force between said endless film and the non-adhered edge portion of the thus coated sheet to peel said coated sheet from said endless film.

Viewed from another aspect the invention provides apparatus for processing a sheet surface comprising: a supply section for supplying sheets, an applying section for applying an ultra-violet hardening resin coating material on one surface of an endless film made of an ultra-violet ray transmissible material and having at least part of its surface matted or on the surface of a sheet to be processed; a laminating section for laminating one surface of said sheet to be coated, except for its edge portion, on the endless film in a substantially non-oxygen state by means of a pressurizing roller and a receiving roller forming a pair therewith whereby said coating material is sandwiched between said sheet and said endless film; a hardening section for irradiating the ultra-violet ray hardening resin coating material with ultra-violet radiation through said endless film to harden the ultra-violet ray hardening resin coating material so as to adhere the hardened ultra-violet ray hardening resin coating material on said sheet to be coated; a peeling section for applying an external force between said endless film and a non-adhered edge portion of the coated sheet to peel said coated sheet from said endless film; and a film delivering section for delivering and circulating said endless film through said laminating section, and said hardening section.

The term "endlelss film" is used to describe any arrangement which permits the substantially continuous supply of film. In one embodiment this may taken the form of a film loop. Another possibility, for example, is the provision of one or more rolls of film from which film may be withdrawn and then rewound for future use.

Several embodiments of the invention will now be described by way of example and with reference to the accompanying drawings, in which:-

Fig. 1 is a lateral view showing a sheet surface processing apparatus which embodies a method according to the present invention;

Fig. 2 is a lateral view showing a coating material applying section and gluing section of the sheet surface processing apparatus;

Fig. 3 is plan view showing a state where a sheet to be coated is placed through an ultra-violet ray hardening resin on an endless film;

Fig. 4 is a perspective view showing part of a film delivering section;

Figs. 5 - 8 are plan views showing a variety of endless films;

Fig. 9 is a lateral view showing a peeling section of the sheet surface processing apparatus;

Fig. 10 is a lateral view showing a coating material applying section of another embodiment of the present invention;

Fig. 11 is a lateral view showing a sheet surface processing apparatus according to another embodiment of the present invention;

Fig. 12 is a plan view showing a state where an ultra-violet ray hardening resin is applied on a sheet to be coated; and

Fig. 13 is a lateral view showing a coating material applying section and a gluing section of the sheet surface processing apparatus of the other embodiment.

In the drawings, a sheet surface processing apparatus 1 comprises a supply section 3 for supplying a sheet to be coated 2 such as paper; a coating material applying section 7 for applying an ultra-violet ray hardening resin coating material (hereinafter simply called "the UV coating material") 6 on an endless film 9 made of an ultra-violet ray transmittible material which has at least part of its surface processed in a mat pattern 8; a laminating section 13 for laminating one surface 4 of the sheet to be coated 2, except for its hedge portion, on a coating material applied surface 10 of the endless film 9, the coating material applied surface 10 and the one surface 4 being laminated in a substantially non-oxygen state by a pressurizing roller 11 and a receiving roller 12 forming a pair with the pressurizing roller 11; a hardening section 14 for irradiating the UV coating material 6 applied on the surface 10 with an ultra-violet ray through the endless film 9 to harden the UV coating material 6 and thus adhere the UV coating material 6 on the sheet to be coated 2; a peeling section 15 for applying an external force between the endless film 9 and the non-adhered edge portion 5 of the coated sheet 2 to peel the coated sheet 2 from the endless film 9; a film delivering section 16 for delivering and rotating the endless film 9 through the laminating section 13 and the hardening section 14; and a discharging and stacking section 17 for discharging and stacking the peeled coated sheet 2.

The supply section 3, which stores therein a multiplicity of sheets to be coated 2 which may be multi-color printed sheets of paper possibly printed by a sheet printing machine or the like and supplies the same one by one to the laminating section 13, also performs the alignment of the sheet to be coated 2 in the vertical and width directions with an aligner. The coating material applying section 7 and the supply section 3 are electrically or mechanically coupled to each other such that the

supply section 3 supplies a sheet to be coated 2 per one rotation of a plate roller 23 on which is mounted a plate 20 of the coating material applying section 7, as will be next described in detail.

The coating material applying section 7 is positioned above the laminating section 13 and comprises a plate 20 for applying the UV coating material 6 over the endless film 9 such that the edge portion 5 of the surface 4 of the sheet to be coated 2 is not applied with the UV coating material 6; and at least kneading rollers 21 and 22 for substantially uniformly supplying the UV coating material 6 onto the plate 20.

The plate 20 is attached around the plate roller 23, and the UV coating material 6 kneaded by the kneading rollers 21, 22 is transferred onto the plate 20, such that the UV coating material applied surface 10 is formed over the endless film 9 as described above while the endless film 9 passes between the plate roller 23 and the pressurizing roller 11 in contact therewith (see Fig. 2). If the surface of the plate 20 is such that the endless film 9 is laminated on the surface 4 of the sheet to be coated 2 except for its edge portion through the UV coating material 6, the UV coating material 6 is applied over the endless film 9 in that shape. Instead, if the shape of the plate 20 is such that an overlap width, for example, is left, the UV coating material 6 is applied in that shape. It is therefore possible to form a coating material applied surface in a desired shape on the surface of the endless film 9 in accordance with the surface shape of the plate 20, which leads to finally adhere a coating material applied surface in a desired shape on the surface 4 of the sheet to be coated 2.

Incidentally, reference numeral 25 in Fig. 2 designates a pipe for supplying the UV coating material 6 to the kneading rollers 21, 22; 26 a coating material receiving tray for preventing the UV coating material 6 from dripping; and 28 supporting rollers for the sheet to be coated 2.

The laminating section 13 passes the endless film 9 after the coating material applied surface 10 has been formed by the coating material applying section 7 and the sheet to be coated 2 supplied from the supply section 3 between the pressurizing roller 11 and the receiving roller 12 under a predetermined pressure, whereby the sheet to be coated 2 is adhered on the coating material applied surface 10 of the endless film 9 to realize a substantially non-oxygen state and transfer the surface shape of the endless film 9, as will be later described in detail. The pressurizing roller 11 has its roller surface finished in a mirror fashion. Generally, a hard chrome plating is processed to realize such a mirror surface. The receiving roller 12 forming a pair with the pressurizing roller 11 has its roller surface wound by an elastic plate such as a rubber plate in a manner that the pressurizing roller 11 and the receiving roller 12 do not contact with a line but with a predetermined width. This structure is necessary for temporarily maintaining the coating material applied surface 10 of the UV coating material 6 in a substantially non-oxygen state.

The endless film 9 has a seam 9a which renders the film endless. This endless film 9 is stretched over the pressurizing roller 11 which also serves as a driving roll constituting the film delivering section 11, a peeling roller 36 and a group of rollers 52. A correcting guide 52 is provided for the endless film 9 and the pressurizing roller 11. Specifically, the correcting guide 52 comprises a plurality of guide pins 54 equally spaced on roller surfaces on both end portions of the pressurizing roller 11, and guiding perforations 55 are formed through the endless film 9 such that the guide pins 54 are inserted into the perforations 55. By virtue of this guide 52, when the pressurizing roll 11 is driven, the endless film 9 runs along the guide pins 54, whereby a deviation from its normal position is restricted and accordingly meandering of the endless film 9 is prevented.

The longitudinal length of the endless film 9 is set to an integer multiple of the circumference of the plate roller 23. Therefore, when the endless film 9 is passed around the pressure roller 11 and so on in a manner that the seam 9a of the endless film 9 will not, at the beginning, be contacted with the coating material applied surface 10 which has been applied with the UV coating material 6 by the plate roller 23, the coating material applied surface 10 will not coincide with the seam 9a of the endless film 9. The seam 9a can therefore be easily processed because its mark will not remain on the coating material applied surface 10.

The ultra-violet ray transmissible material for manufacturing the endless film 9 may be generally a transparent film made, for example, of polypropylene, polyethylene terephthalate or polyethylene. This endless film 9 may vary as shown in Figs. 5 - 8. An endless film 9a shown in Fig. 5 has its whole surface formed in a mat-like pattern 8. By the use of this endless film 9a, the sheet 2 with the UV coating sheet, although formed of a resin film, has its entire surface delustered or matted. Such a matted surface prevents reflection of light which may hinder the user from viewing and provides a good touch. It is further advantageous in that a fingerprint is not easily attached on it, stain on it is not easily recognized, and it has the water-borne property. Another endless film 9b shown in Fig. 6 has part of its surface 8 made mat and the remaining portion 32 formed in a mirror surface.

In an endless film 9c shown in Fig. 7, an arbitrary uneven pattern 33 is regularly aligned on the entire surface. An endless film 9d shown in Fig.

8 has part of its surface covered with such arbitrary uneven pattern 33 and the remaining portion thereof formed in a mirror surface 32.

The foregoing hardening section 14 has a conveyer 34 which supports the sheet to be coated 2 which has its lower portion attached to the endless film 9 and moves together with the endless film 9, and two sets of ultra-violet ray emitters 35 above the conveyer 34. The coating material applied surface 10 is exposed to ultra-violet rays emitted from these ultra-violet ray emitters 35, after the coating material applied surface 10 of the sheet 2 has been laminated to the endless film 9 and a substantially no-oxygen state has been established, whereby the UV coating material 6 on the applied surface 10 is instantaneously hardened, and the UV coating material 6 is adhered on the sheet to be coated 2 in accordance with the difference in wettability between the sheet to be coated 2 and the endless film 9 (the wettability is a parameter of the affinity between a solid and a liquid in an adhering phenomenon of a solid and a liquid. As the wettability is larger, the affinity is also larger. In other words, the affinity means easiness of adhesion. The present invention utilizes the fact that the sheet to be coated is more susceptible to be wet). Further, since the edge portion 5 of the sheet to be coated 2 has a coating material non-applied portion extending, for example, over 5 - 10 mm, even if the sheet to be coated 2 having the applied surface 10 is passed between the pressurizing roller 11 and the receiving roller 12, the UV coating material 6 will not overflow between the sheet to be coated 2 and the endless film 9. Since the UV coating material 6 will never be irradiated with an ultra-violet ray in an oxygen-existing state (it is generally known that the hardening of the UV coating material by an ultra-violet ray is finished four or five times faster in a non-oxygen state than in an oxygen-existing state), insufficiently hardened UV coating material 6 will not remain on the endless film 9.

The peeling section 15 has a nozzle mounted on a pipe which is disposed in parallel to a peeling roll 36. A blowing direction of the nozzle 38 is oriented to the direction between the endless film 9 on the peeling roller 36 and the uncoated edge portions 5 of the coated sheet 2. Then, an external force is applied by blowing out air from a pressurized air source connected to the pipe 37 from the nozzle 38. The coated sheet 2 peeled off the endless film 9 is collected to the discharging and stacking section 17 by a conveyer 40.

Incidentally, the coating material applying section 7 may be located between intermediate pressing rollers 28 and the pressurizing roller 11 and the receiving roller 12 in Fig. 1. As shown in Fig. 10, in the process of passing the sheet to be coated 2 transported by the intermediate pressing rollers 28 between the plate roller 23 and a backup roller 24 opposite thereto, if the surface 4 of the sheet to be coated 2 is applied with the UV coating material 6 by the plate roller 20, except for the edge portion 5, to form the coating material applied surface 10a, and thereafter the applied surface 10a of the sheet to be coated 2 is laminated on the endless film 9 by passing both between the pressurizing roller 11 and the receiving roller 12, the same result will be obtained. Reference numeral 27 in Fig. 10 designates a tray for receiving the UV coating material 6 which may drop downwardly.

Next, description will be made to a sheet surface processing method by the use of a sheet surface processing apparatus 1 constructed as explained above.

After finishing necessary preparations, a required number of sheets to be coated 2 such as paper printed in multiple colors by a sheet printer is set in the supply section 3.

Next, the sheets to be coated 2 are one by one supplied from the supply section 3 to the laminating section 13 forcibly by the pressing rollers 28. Simultaneously, the pressurizing roll 11, which also serves as a driving roller for the endless film 9 is rotated to pass the endless film 9 between the plate roller 23 and the pressurizing roller 11 of the coating material applying section 7 to apply the endless film 9 with the UV coating material 6. In this event, the UV coating material 6 is supplied from the pipe 25 to the pair of kneading rollers 21 which knead and extend the UV coating material 6 uniformly. The UV coating material 6 thus extended is further transferred to the plate 20 attached on the plate roll 23. Since one of the sheets to be coated 2 is supplied from the supply section 3 every time the plate roller 23 rotates once, the endless film 9 is applied with the UV coating material 6 from the plate 20 at this interval. Then, the endless film 9 is passed between the pressurizing roller 11 and the receiving roller 12 under a predetermined pressure together with each sheet to be coated 2 which has been forcibly supplied to the laminating section 13, whereby the sheets to be coated 2 except for the edge portion thereof are one by one laminated on the surfaces 10 applied with the UV coating material 6 of the endless film 9.

Simultaneously, the coating material applied surface 10 is processed in a variety of shapes of the endless film 9, for example, in accordance with the endless film 9a, 9b, 9c, 9d and so on and made substantially in a non-oxygen state. Incidentally, in the process until the sheet to be coated 2 is laminated to the endless film 9, the same results will be obtained if the sheet to be coated 2 is first applied with the UV coating material 6 and then the

sheet to be coated 2 is laminated on the endless film 9 through the UV coating material 6. Then, with the movement of the endless film 9, the sheet to be coated 2 is sent to the hardening section 14, where the UV coating material 6 is immediately hardened by an ultra-violet ray emitted from the ultra-violet ray emitters 35 to the coating material applied surface 10 through the endless film 9. Next, from the nozzle 38 of the pipe 37 disposed in the peeling section 15, air is blown out between the non-adhered edge portion 5 of the coated sheet 2 and the endless film 9 to peel the coating material applied surface 10 of the coated sheet 2 from the endless film 9, thus completing the formation of a pattern on the surface of the sheet 2. It should be noted that a variety of patterns can be formed on the surface by changing the shape or pattern of the endless film 9.

According to the present embodiment as described above, a sheet to be coated can be formed with not only a lustered surface but also a variety of patterned surfaces. Additionally, the following effects are also produced:

(1) Since a pure UV coating material is used, a heat drying process is not necessary;

(2) The applying stage does not require a leveling zone or a heating process which are generally employed to remove irregular coating;

(3) When the UV coating material is hardened, the ultra-violet ray irradiating efficiency is three to four times higher than before since oxygen obstacle does not arise;

(4) As a result of the effects (1) - (3), energy can be saved in comparison with a conventional UV coating method.

(5) Since unhardened UV coating material does not remain on the surface of the endless film, the endless film is free from stain and thus repeatedly usable; and

(6) A variety of surface patterns which cannot be obtained only by coating are provided.

Fig. 11 shows a sheet surface processing apparatus 1a which is another embodiment of the present invention. This embodiment differs from that shown in Figs. 1 - 9 in that a film roll 50 is used instead of the endless film 9, and the UV coating material 6 is first applied on the sheet to be coated 2 and the film roll 50 is adhered on an applied surface 10a of the sheet to be coated 2, as shown in Fig. 11.

More specifically, this sheet surface processing apparatus 1a has a film delivering section 16 located at the position of the coating material applying section in Fig. 1, a coating material applying section 7 located between a pair of pressing rollers 28 and a set of a pressurizing roller 11 and a receiving roller 12, and a conveyer 30 for transporting the sheet to be coated 2 after applied with the UV coating material 6 to a laminating section 13.

The film delivering section 16 is positioned above the laminating section 13 and has a releasing roller 41 around which the film roll 50 is wound, a spare roll 42 therefor, and a take-up roll 43. These rolls 41, 42 and 43 are in the same shape and mountable and removable with respect to mounting bases. The film roll 50 released from the releasing roll 41 passes between the pressurizing roller 11 and the receiving roller 12 of the laminating section 13, below ultra-violet ray emitters 35, through a peeling roller 36 and wound around the take-up roll 43. Thus, when most of the film roll 50 released from the roll 41 has been wound around the take-up roll 43, the remaining film roll 50 on the releasing roll 41 is connected to a spare film roll 50 prepared on the spare roll 42, and the film roll 50 is completely wound by the take-up roll 43. Then, the releasing roll 41 without film is replaced with the take-up roll 43 around which the film roll 50 has been wound, and the spare film rolls 50 on the spare roll 42 is wound by the empty releasing roll 41, thereby alternately using the film rolls 50.

The rest of the structure and the action of this embodiment are similar to the embodiment of Figs. 1 - 8, so that the same reference numerals are designated to like constituents and explanation thereof will be omitted.

As an alternative to applying the UV coating material to the sheets 2 before lamination (Fig. 11), Fig. 13 shows that the UV coating material can also be applied to the film 50 similarly to the first embodiment. In this case the coating material applying section 7 is disposed at a location between the pressurizing roller 11 of the laminating section 12 and the releasing roll 41 of the film delivering section 16 in Fig. 11. The UV coating material 6 is applied on the film 50 by means of a plate 20 attached around a plate roll 23 of the coating material applying section 7. Then, the applied surface 10a of the film 50 is contacted on one surface 4 of the sheet to be coated 2 except for an edge portion 5 thereof by passing them between the pressurizing roller 11 and the receiving roller 12 of the laminating section 13.

As described above in detail, according to the sheet surface processing method of the present invention, an ultra-violet ray hardening resin coating material is applied on a film made of an ultra-violet ray transmissible material and having at least part thereof matted, and one surface of a sheet to be coated such as paper is pressed against the applied surface of the endless film so that they are contacted together, except for the edge portion of the sheet, in a substantially no-oxygen state. The ultra-violet ray hardening resin coating material on the applied surface is irradiated with an ultra-violet ray through the film to be immediately hardened.

The ultra-violet ray hardening resin coating material is all adhered on the sheet to be coated due to the difference in wettability between the sheet to be coated and the film. Then, an external force is applied to an edge portion to peel the coated sheet from the film, thereby making it possible to readily and freely produce a mat resin coating and a lustrered surface. Since an endless film is used, or continuously alternated film rolls, a long resin film is not required. This mat resin coating is advantageous in preventing reflection of a light which may hinder the user from viewing, providing a good touch, preventing a fingerprint from being attached thereon, making stain thereon unrecognizable, and providing a water-repellant property.

Alternatively, the ultra-violet ray hardening resin coating material is first applied on one surface of a sheet to be coated except for its edge portion, and the applied surface of the sheet to be coated is pressed against the film such that they are contacted together in a substantially non-oxygen state, thereby providing a resin coating producing similar effects to the above.

If the foregoing film has at least part of its surface processed in an uneven pattern of arbitrary shape, such the uneven pattern of arbitrary shape or a lustered surface can be readily and freely formed on the sheet to be coated.

Also, according to the sheet surface processing apparatus of the present invention, a film made of an ultra-violet ray transmissible material and having at least part of its surface matted is delivered from a film delivering section to a coating material applying section wherein the film is applied with an ultra-violet ray hardening resin coating material. Meanwhile, a sheet to be coated such as paper is supplied to a laminating section wherein the applied surface of the endless film is pressed against one surface of the sheet to be coated by means of a pressurizing roller and a receiving roller such that they are contacted together in a substantially non-oxygen state except for the edge portion of the sheet. Under this condition, an ultra-violet ray is irradiated from a hardening section through the endless film to harden the ultra-violet ray hardening resin coating material in a manner that this coating material is adhered only on the sheet to be coated. Then, an external force is applied from a peeling section to peel the coated sheet from the film, thereby providing a mat resin coating and a lustered surface.

Further, a sheet to be coated may be supplied from a supply section to a coating material applying section wherein an ultra-violet ray hardening resin coating material is first applied on one surface of the sheet to be coated except for its edge portion, while a film is delivered from a delivering section to a laminating section. The coating material applied surface of the sheet is pressed against the film by means of a pressurizing roller and a receiving roller such that they are contacted together in a substantially non-oxygen state, with the result that similar mat resin coating and lustered surface are provided.

If the film has at least part of its surface processed in an uneven pattern of arbitrary shape, such the uneven pattern of arbitrary shape and lustered surface are formed on the coated sheet.

The use of a correcting guide for restricting lateral movements of the film restricts the running position of the rotating film and prevents the same from meandering, which leads to stabilizing the operation of the apparatus and accordingly improving the operation ratio.

With this restriction of the film by the correcting guide, if the longitudinal length of the film is set to be an integer multiple of the circumference of a plate roller of the coating material applying section, a seam of the film will never be positioned on a coating material applied surface of a sheet to be coated, thereby making quite easy a seam processing during the fabrication of the film, in addition to the foregoing effects.

Further, even if a roll film is substituted for the endless film, a coated sheet can be readily and freely provided with the same mat resin coating, lustered coating, surface formed with arbitrarily shaped uneven pattern and lustered surface as those provided by the foregoing method and apparatus.

It will thus be seen that there is provided a sheet surface processing method and apparatus for implementing this method which are capable of providing a variety of patterns on a printed surface of a sheet, in addition to maintaining the advantages provided by the foregoing JP-A-63-278847 of the same assignee. Since the present invention does not require a long and large resin film, the whole structure is made simple, the size of the apparatus is reduced, and the operation is easy.

Claims

1. A method of processing a sheet surface comprising the steps of: applying an ultra-violet hardening resin coating material on an endless film made of an ultra-violet transmissible material and having at least part of its surface matted or on the surface of said sheet to be processed; laminating the sheet and said endless film so that said coating material is sandwiched between said sheet and said endless film except for an edge portion; irradiating the ultra-violet ray hardening resin coating material with ultra-violet radiation through said endless film to harden the ultra-violet hardening resin

coating material in such a manner that the ultra-violet ray hardening coating material is adhered on said sheet to be coated; and applying an external force between said endless film and the non-adhered edge portion of the thus coated sheet to peel said coated sheet from said endless film.

2. A method as claimed in claim 1 wherein said irradiation of said coating material is performed in a non-oxygen state.

3. A method as claimed in claim 1 or 2, wherein said endless film has at least part of its surface formed in an uneven pattern of arbitrary shape.

4. Apparatus for processing a sheet surface comprising: a supply section for supplying sheets, an applying section for applying an ultra-violet hardening resin coating material on one surface of an endless film made of an ultra-violet ray transmissible material and having at least part of its surface matted or on the surface of a sheet to be processed; a laminating section for laminating one surface of said sheet to be coated, except for its edge portion, on the endless film in a substantially non-oxygen state by means of a pressurizing roller and a receiving roller forming a pair therewith whereby said coating material is sandwiched between said sheet and said endless film; a hardening section for irradiating the ultra-violet ray hardening resin coating material with ultra-violet radiation through said endless film to harden the ultra-violet ray hardening resin coating material so as to adhere the hardened ultra-violet ray hardening resin coating material on said sheet to be coated; a peeling section for applying an external force between said endless film and a non-adhered edge portion of the coated sheet to peel said coated sheet from said endless film; and a film delivering section for delivering and circulating said endless film through said laminating section, and said hardening section.

5. Apparatus as claimed in claim 4 wherein said film delivering section includes means for delivering said film to said applying section.

6. Apparatus according to claim 4 or 5, wherein said endless film has at least part of its surface formed in an uneven pattern of arbitrary shape.

7. Apparatus according to claim 4, 5 or 6, wherein said endless film is restricted in its running position by a correcting guide disposed in said film delivering section.

8. Apparatus according to any of claims 4 to 7 wherein the longitudinal length of said endless film is set to an integer multiple of the circumference of a plate roller for applying the ultra-violet ray hardening resin coating material.

Fig.1

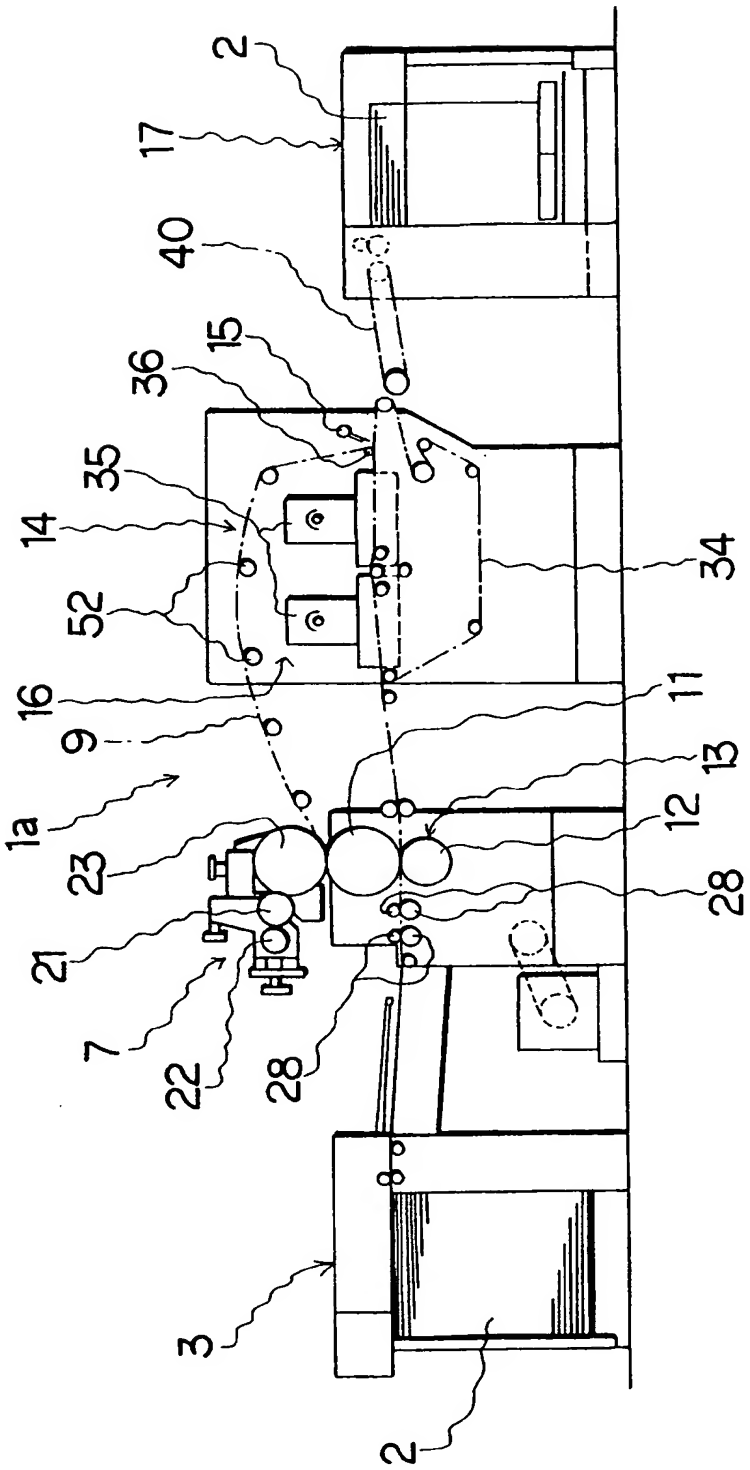


Fig.2

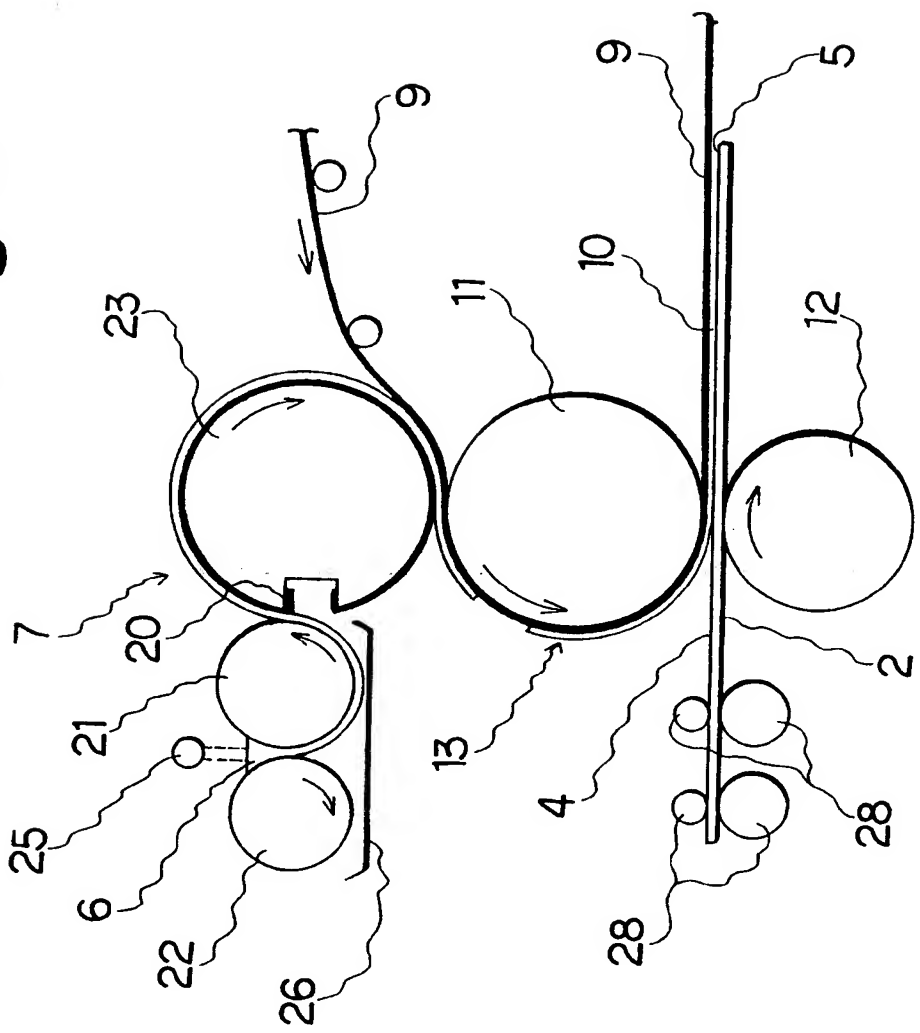


Fig.3

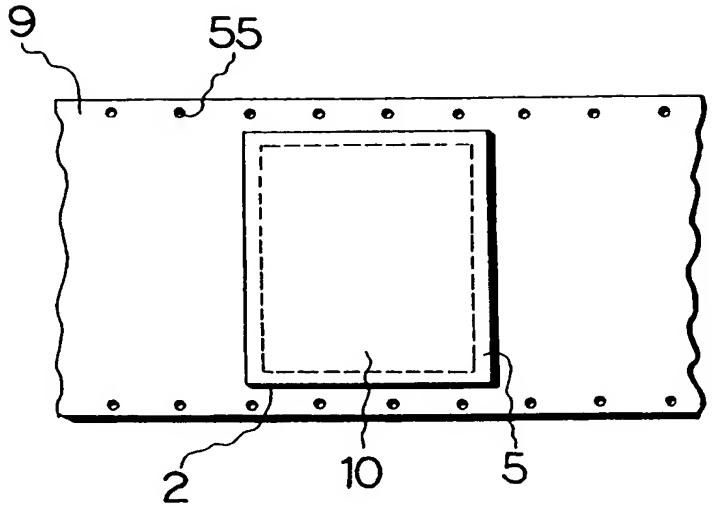


Fig.4

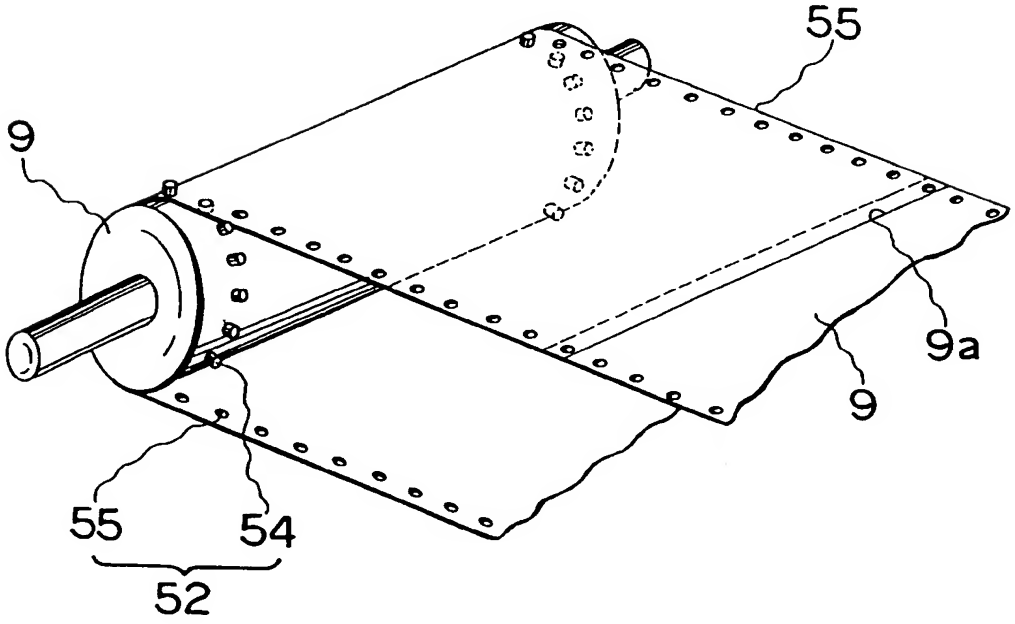


Fig.5

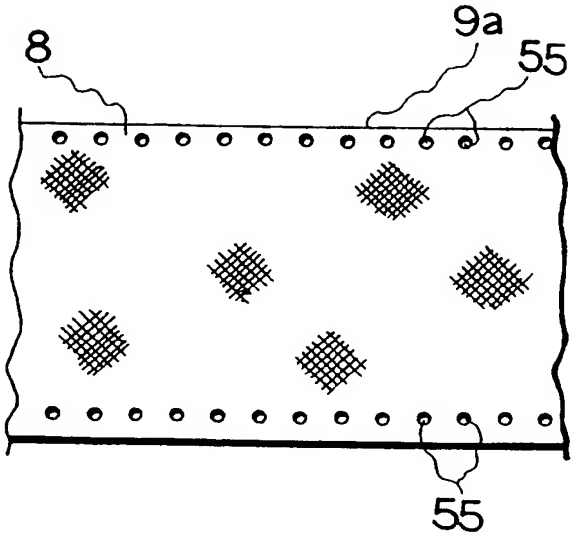


Fig.6

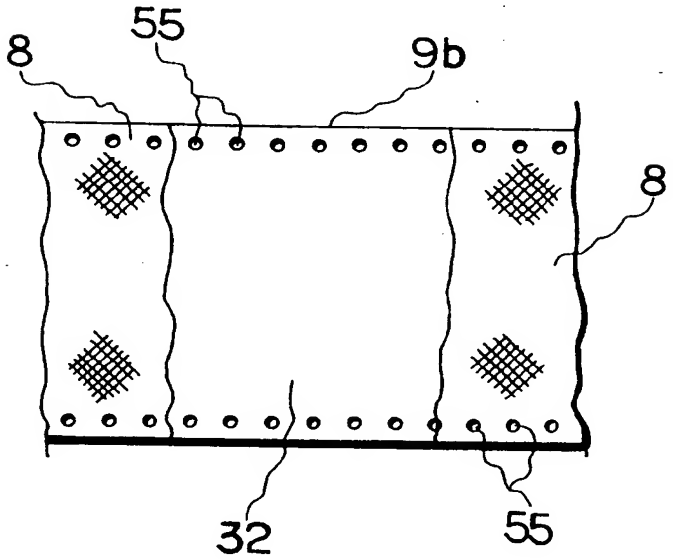


Fig.7

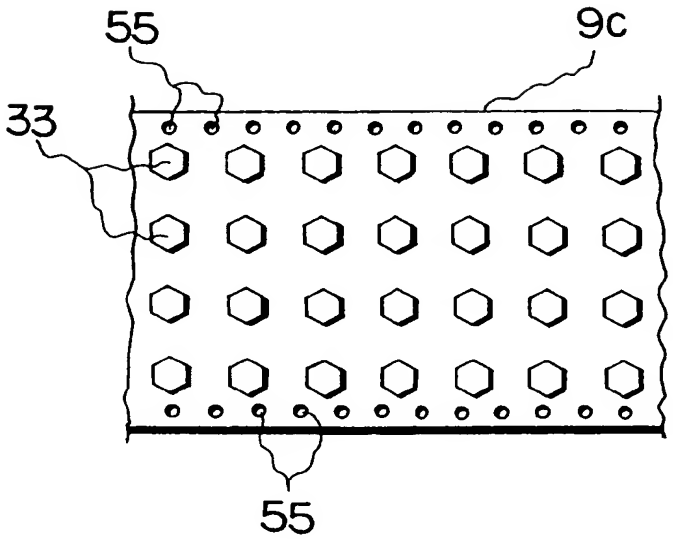
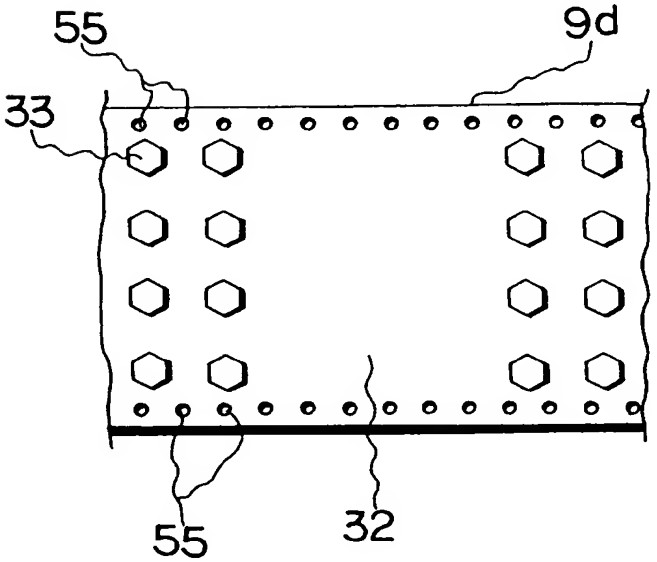


Fig.8



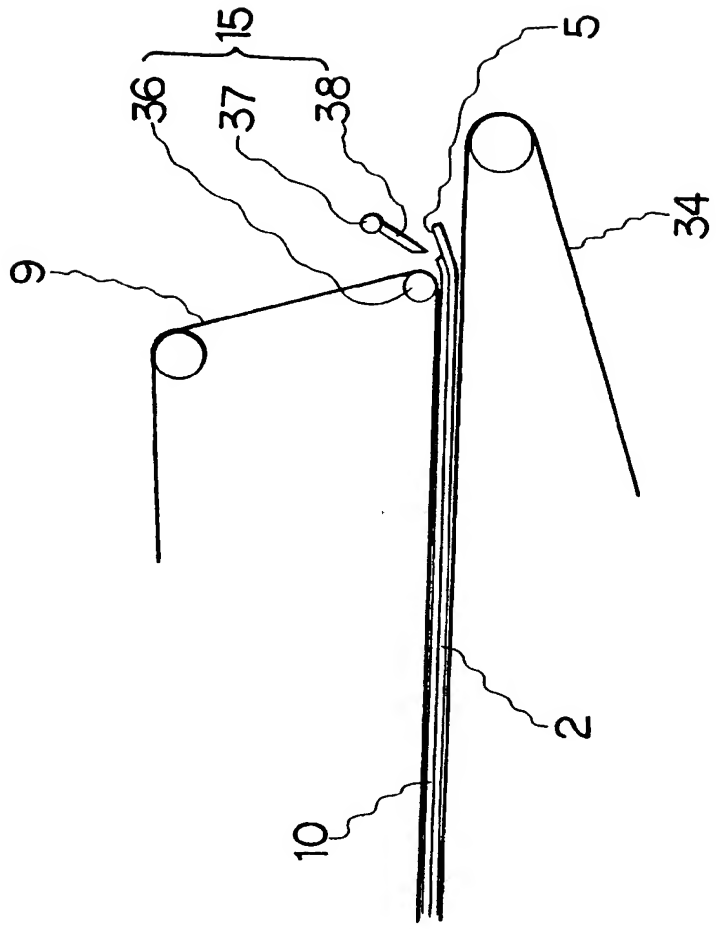


Fig.9

Fig.10

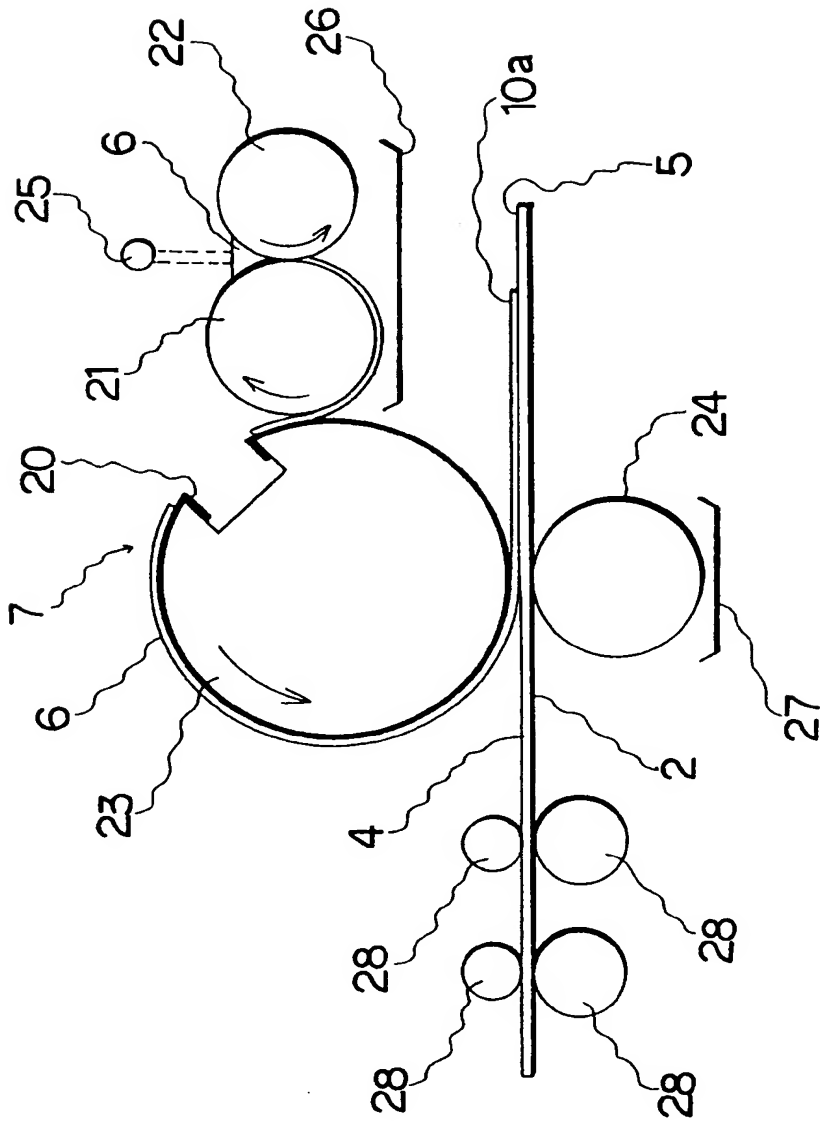


Fig.11

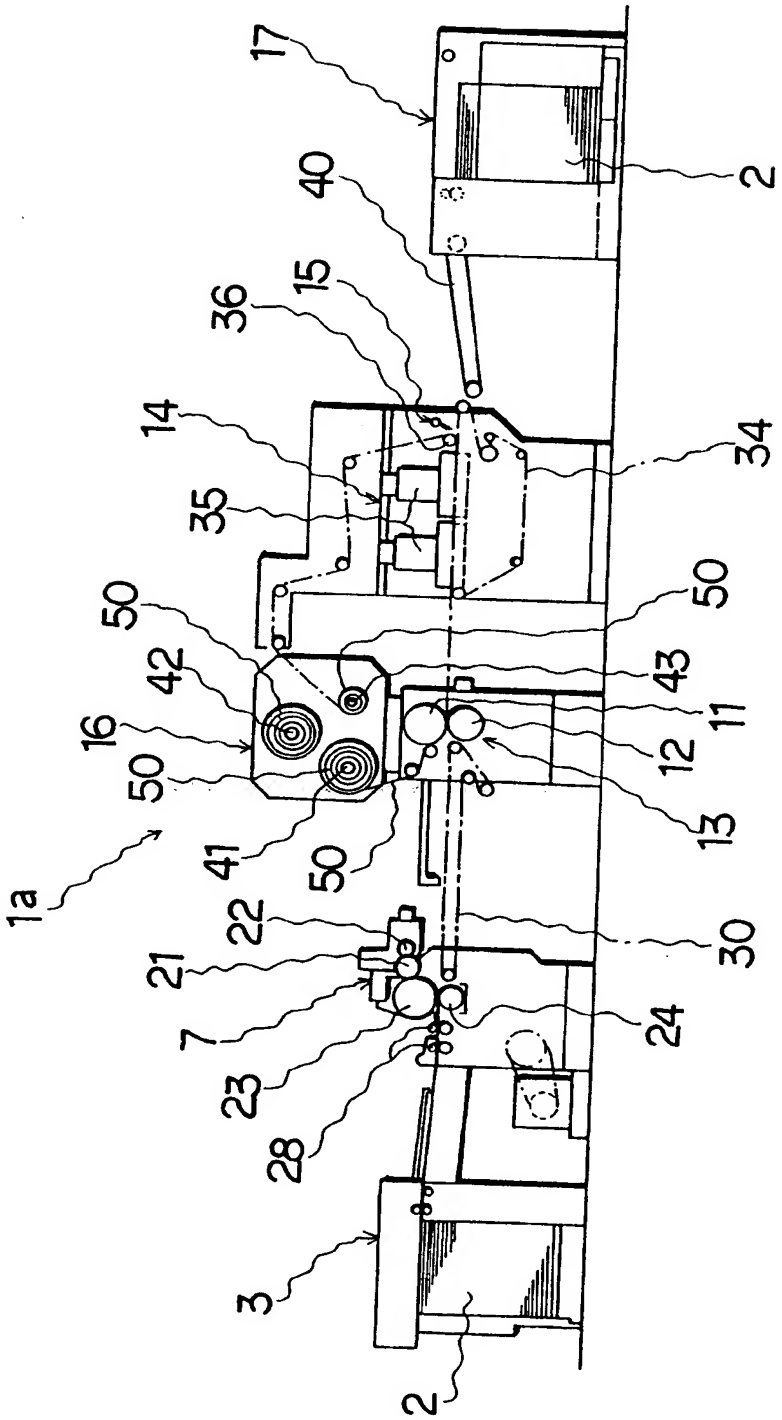


Fig.12

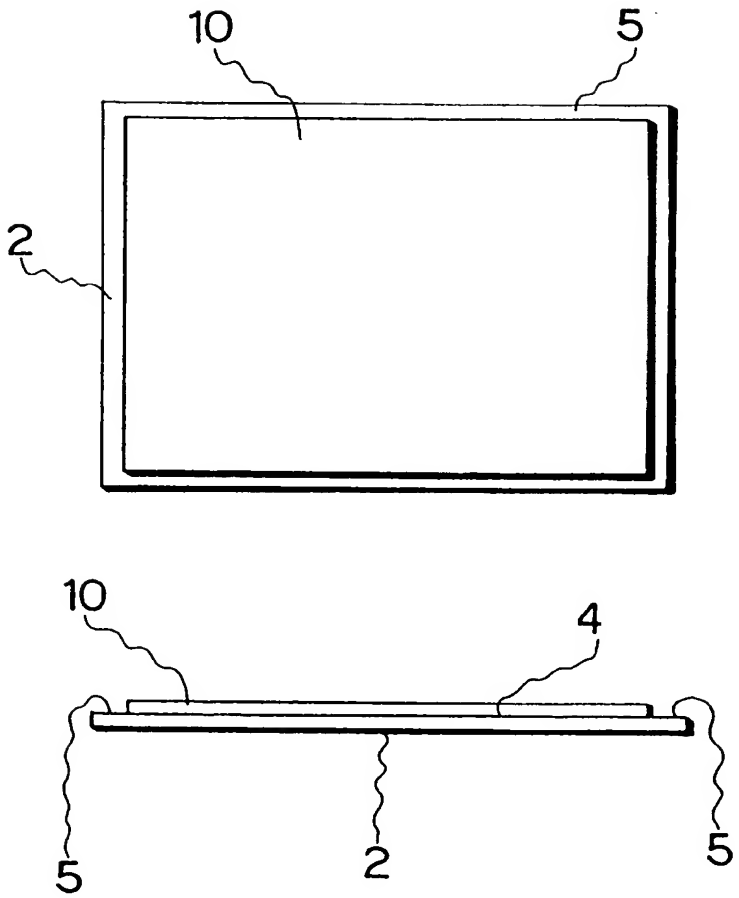
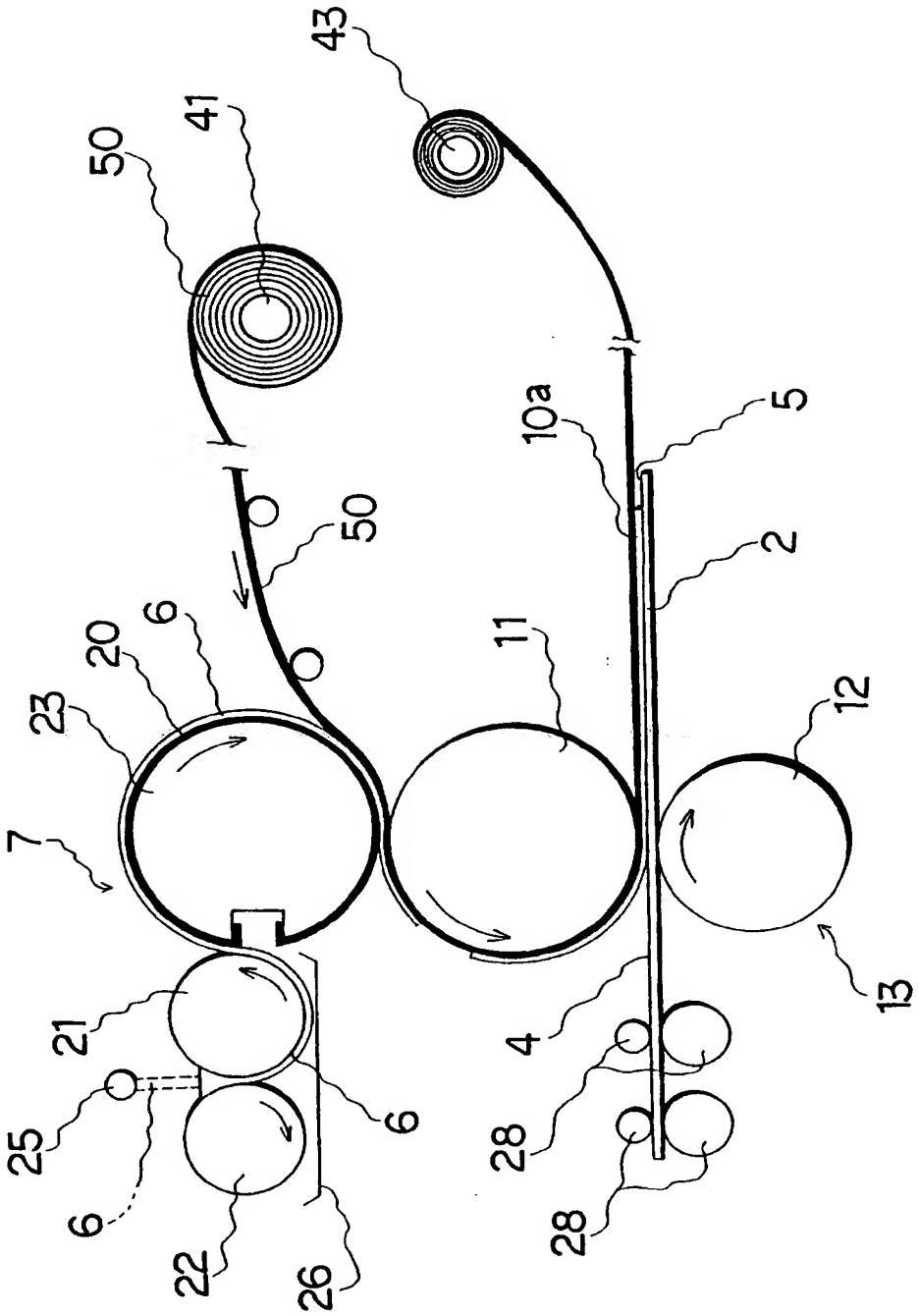


Fig.13



European Patent Office

EUROPEAN SEARCH REPORT

Application Number
EP 92 30 8341

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DATABASE WPIL Section Ch, Week 8901, Derwent Publications Ltd., London, GB; Class A32, AN 89-002662 & JP-A-63 278 847 (HAMAMATSU) & Derwent Publications Ltd., London, GB; * abstract *	1-8	B41M7/02 B05D1/28
X	JP-A-63 278 847 (HAMAMATSU) * figures 1-4 *	1-8	
A	WO-A-8 001 472 (SICPA HOLDING SA) * page 2, line 10 - line 21 * * page 3, line 15 - line 22 * * page 5, line 23 - line 25 *		
A	US-A-3 713 935 (G. GRECCHI) * column 2, line 31 - line 39 * * column 3, line 38 - line 47 *		
A	DE-A-2 716 759 (FUJI PHOTO FILM) * figures 6,7,9 *		TECHNICAL FIELDS SEARCHED (Int. Cl.5) B41M B05D B41F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	14 OCTOBER 1993	HAENISCH U.P.

CATEGORY OF CITED DOCUMENTS

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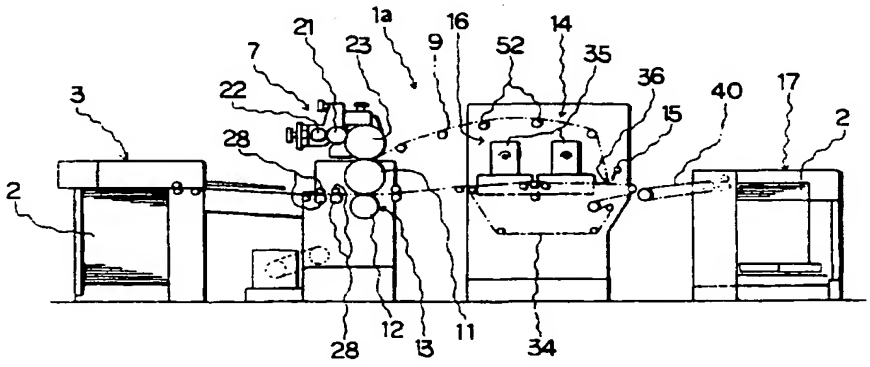
(54) Sheet surface processing method and apparatus

[57] The present invention provides a printed sheet with a resin coating, lustered surface, a surface pattern of arbitrary shape and so on without using a long and large resin film. An ultra-violet ray hardening resin coating material is applied on one surface of a sheet to be coated 2 except for its edge portion. The coating material applied surface of the sheet 2 is laminated in a substantially non-oxygen state on an endless film 9 made of an ultra-violet ray transmissible material and having its surface matted or formed in an uneven pattern of arbitrary shape. The ultra-violet ray hardening coating material on the applied surface is irradiated through the endless film 9 with an ultra-violet ray to be hardened such that it is adhered on the sheet to be coated 2. Then, an external force is applied to the edge portion of the coated sheet 2 to peel the same from the endless film 9. Thus, a variety of patterned surfaces can be provided without the necessity of a long and large resin film.

Fig.1



EP 0 578 886 A1 CORRIGENDUM issued on 12.11.1997 (bibliography updates included)